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ABSTRACT

Lawrence Central High School (LHS) is a suburban school near Indianapolis, Indiana, that implemented in 1998-1999 an extensive remediation program to increase the passing rates of their students taking the state's mandated competency examination, the Indiana State Testing for Education Progress (ISTEP) examinations. The number of students in the class of 2000 who failed either the mathematics or English component of the test dropped from 406 students in the beginning of the implementation year to 74 students by the end of the year. An evaluation was conducted to study the manner in which the PLATO (registered) Pathways program was used in the mathematics and English remediation courses at LHS, to examine the effectiveness of the ISTEP remediation effort, and to suggest possible areas of improvement for future PLATO implementation and use. Student ISTEP scores increased dramatically in the fall 1998 and spring 1999 retests, and a significant positive relationship was identified between student grades achieved in the fall 1998 Skills courses and ISTEP test scores. Students reported that the PLATO computer lessons made them feel more confident about doing well in school, and they generally agreed that the PLATO courseware was easy to use, easy to understand, allowed them to work at their own pace, and that they tried hard to learn from their assigned PLATO modules. Teachers generally were positive about PLATO courseway and believed it contributed to student improvement on the ISTEP courses. Suggestions are outlined for maximizing the effectiveness of future PLATO use at LHS. (Contains 6 tables and 18 references.) (Author/SLD)

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PLATO
Evaluation Series

**Lawrence Central High School,
Indianapolis, IN**

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Executive Summary

Lawrence Central High School (LHS) is an Indianapolis suburb school that implemented in 1998-1999 an extensive remediation program to increase the passing rate of their students taking the state-mandated competency exam, ISTEP. The number of students in the class of 2000, who failed either the math or the English component of the test dropped from 406 students in the beginning of the implementation year, to 74 students by the end of the year.

The purpose of this evaluation report is to describe the manner in which the PLATO® Pathways program has been used within the Math and English remediation courses at LHS, to examine the effectiveness of the ISTEP remediation effort, and to suggest possible areas of improvement for future PLATO® implementation and use.

Some of the more important results of this evaluation include:

- Student ISTEP scores increased dramatically in both the Fall 1998 and Spring 1999 re-tests
- A significant positive relationship was identified between student grades achieved in the Fall 1998 Skills courses and the ISTEP test scores for both Fall 1998 and Spring 1999
- Students reported that the computer lessons made them feel more confident about doing well in school
- Students generally agreed that PLATO® courseware was easy to use, easy to understand, allowed them to work at their own pace, and they tried hard to learn from their assigned the PLATO modules
- Teachers generally were positive about PLATO courseware and believed that it contributed to student improvement on the ISTEP courses.

Six tables are included in the evaluation which detail ISTEP test results and instructor and learner attitude survey results. Suggestions are outlined for maximizing the effectiveness of future PLATO use at LHS.

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Introduction

This report describes the PLATO-supported strategies used by Lawrence Central High School, Indianapolis IN, to remediate students who failed the state mandated high school competency exam, the Indiana Statewide Testing for Educational Progress (ISTEP) test. The ISTEP test has been a graduation requirement in Indiana since 1997 and has forced all high schools in the state to devise an effective plan to deal with failing students. The remediation program adopted by LHS this year succeeded in decreasing the number of students who failed the ISTEP re-test. Consider that of the 408 students (class of 2000) who failed at least one part of the ISTEP test before 1998, only 74 were still failing by the end of this year. This report evaluates the general effectiveness of the school's remediation strategy – which included both PLATO interventions and traditional classroom instruction

LHS is located in northeastern Indianapolis, Indiana and serves a diverse student population. The principal, Ms. Caroline Hanna, describes five distinct demographic groups that feed the school: 1) an affluent community, 2) an upper-middle class community, 3) a blue-collar community, 4) a community with a high military population (the residue of a recent base closing), and 5) a poor community. Minorities comprise about 25 % of the student population. Despite being over 30-years old, the school facilities recently underwent massive renovations and are in very good condition, with bright colors and natural light throughout its common areas.

It is worth noting that this improvement in the ISTEP passing rate of the junior class occurred during a year when an unusual number of technical problems hampered the PLATO lab. These problems (described in Appendix A), a result of a PLATO upgrade and server incompatibility, have since been resolved. Thus, it could be argued that LHS's success may have been even more dramatic were it not for the problems isolated in this evaluation year.

The faculty has used PLATO for about eight years in a variety of ways and was quite pleased with it. However, it was only this past academic year, 1998-1999 when they began using PLATO extensively to develop personalized student curriculum for the express purpose of ISTEP test remediation. In both the Math and English remediation courses, PLATO Pathways was implemented to meet the following important needs:

- Align the curriculum to the ISTEP tests
- Address the remediation needs of each learner, since each comes into the program with a wide range of previous experiences and skill level
- Enable teachers to establish learning programs which present a variety of computer-based modules corresponding to their core subject areas
- Provide a motivational way to learn core subject material
- Provide individual assessment and tracking

The purpose of this evaluation report is to describe the manner in which the PLATO Pathways program has been used within the Math and English Skills courses at LHS, to examine the effectiveness of the ISTEP remediation effort, and to suggest possible areas of improvement for future PLATO implementation and use.

Program Description

Learners. Ms. Hanna describes LHS as bimodal, with 70 % of the students achieving at or above grade level, and the other 30 % achieving below, and in some cases significantly below, grade level. It is probably fair to say that it is this low-achieving 30 % that has garnered the greatest amount of attention and effort at LHS since the advent of the ISTEP tests. The learner profile of these low-achieving students is consistent with the literature dealing with at-risk learners: they typically have a short attention span in school; they are poor readers and/or do not like to read; they question the relevance of the things they learn in school; they often feel disenfranchised from the school environment; and they expect to, and in some cases *are expected* to, fail. They need as much one-on-one attention as possible.

Program Goals. LHS used PLATO for a variety of purposes. For example, Calculus students used it as an extra-credit voluntary activity. PLATO was also used to customize math curriculum to remediate students who failed a course, e.g., *Algebra I*, and could not advance to the next level, e.g., *Algebra II*. It was also used to help freshmen who scored poorly (D- or F) in a placement exam to work on targeted basic skills (identified by *Fastrack*). **But the most pressing LHS goal for PLATO, and the focus of this report, was to help increase the passing rate for students who have already failed the Math and/or the English/Language Arts components of the ISTEP test.**

Instructor Characteristics and Role in Program. The role of the instructor was fairly consistent for both the Math and English departments. The instructors designed and aligned the curriculum with LHS's overall goals. In the ISTEP remediation courses – Math Skills and English Skills - the instructors aligned the PLATO curriculum to target the content covered on the ISTEP tests. Each department also used full-time, dedicated lab managers to manage and monitor students' progress through PLATO. The lab manager's role was to facilitate, to the extent possible, each student's curriculum, answer content questions, manage module mastery and testing, and troubleshoot technical problems in the lab. Each department employed two lab managers.

PLATO Implementation Description

A concerted effort to use PLATO to increase the ISTEP passing rate was undertaken this year. Students in need of remediation were enrolled in the newly created Math Skills and English Skills courses and then placed in PLATO modules using *Fastrack*. Once placed in the ISTEP-aligned PLATO curriculum, students then worked at their own pace through the curriculum, advancing to the next module after passing the module mastery test. The lab instructor facilitated student progress individually. Some students also helped others in their proximity.

LHS uses block scheduling with four 1 ½ hour classes daily. LHS has two dedicated PLATO labs for Math and English that are fully booked.

There are three math courses that significantly use PLATO; Problem Solving, Math Prep, and Math Skills. The English department uses PLATO in several courses, but significantly in only the English Skills course. Descriptions follow of how PLATO was implemented in each, but (as mentioned earlier) the focus of the report is on the Math Skills and English Skills courses.

1. Problem Solving – is a course primarily for freshmen who score poorly on the *Iowa Tests of Basic Skills* (ITBS) placement test or have performed poorly in their 8th grade math course. The course uses *Fastrack* to place students in a personalized curriculum thus increasing their chances to succeed in the normal math courses (and to begin preparation for the upcoming ISTEP test).

2. Math Prep – is designed for students who have failed a math course and cannot advance to the next course in the math sequence. Instead of allowing these students to take a year off from math altogether, the Math Prep course uses PLATO to customize a curriculum that enables students to practice the skills necessary to successfully re-take the failed course.

3. Math Skills (ISTEP Remediation) – is offered for students who have failed the math portion of the ISTEP test. It uses the mastery approach whereby students advance through modules at their own pace. In the Fall 1998, students were assigned to the PLATO lab each day for the entire block – 90 minutes each day – to work on PLATO. During the Spring 1999 semester, this schedule was modified to allow students to work alternate days in the PLATO lab and small instructor-led classroom sessions.

4. English Skills (ISTEP Remediation) – is offered for students who have failed the English/Language Arts portion of the ISTEP test. It uses a mastery approach using *Fastrack* for placing students in PLATO. The schedule, like the Spring Math Skills course, allowed students to work alternate days between the PLATO lab and small instructor-led classroom sessions.

Evaluation Design

The present evaluation examines elements of the implementation that are somewhat consistent with both a modified Mastery-Based Program Effectiveness design and an Affective Outcomes design[1]. Neither PLATO module-mastery nor time-in-program data were available for this report, but other useful data were available. Student grades in the English Skills course where PLATO was used extensively were analyzed. In addition, the three most recent student ISTEP scores were examined. Affective outcomes were measured with questionnaires completed by LHS faculty, staff, and students. Site interviews were also conducted with several key staff and faculty.

The current evaluation did not attempt to examine each of the ways PLATO was used at LHS. Rather, it examined only those students in the class of 2000 (rising seniors) who were enrolled in either Math Skills or English Skills. This is the group of students who participated in the concerted remediation effort with extensive use of PLATO. Both the LHS personnel and the evaluator believe that examining this group of students offers the most promise for determining how successful the ISTEP remediation effort has been, and to what extent PLATO has contributed in that success. The number of students enrolled in the Basic Skills courses for the Fall 1998 and Spring 1999 semesters could not be determined exactly but it can be estimated based on ISTEP test results. The total number of students who were still failing after the Fall 1997 ISTEP test was 408 (204 in English and 204 in Math), thus this is likely a close approximation of the students who were enrolled in the respective Skills courses in Fall 1998. There were 185 students (71 in English and 114 in Math) still failing after the Fall 1998 ISTEP test thus this is probably close to the enrollment numbers in the respective Spring 1999 Skills courses.

The PLATO module data (module mastery, time in program) for students who worked in the Skills courses were not available, but student Skills course grades were. Since the Skills course grades were based largely on student performance in PLATO, the course grades and the PLATO data were likely very highly correlated. Thus, while it would have been useful to correlate the PLATO data to the ISTEP test scores, their absence is not a fatal, or even a serious weakness in the current analysis. The evaluation seeks to examine relationships among several variables as well as describe a rich picture of participant attitudes and beliefs.

Data Analysis. Results of instructor and learner surveys are reported. For open-ended survey items, similar responses are summarized and reported. In cases where comments/responses obviously applied to a course not examined here (e.g., Calculus), those comments were not included. In reporting the interview results, common threads and main ideas were collapsed and summarized. In the quantitative analysis, correlations were performed and reported at the .05 alpha level of significance[2]. Differences in ISTEP scores were analyzed using a one-way repeated measure analysis of variance (ANOVA), again at the .05 level. In other

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[1] Foshay, R., *Guidelines for Evaluating Programs Using PLATO.* Technical Paper #2: Edina, MN: TRO Learning, Inc., 1994.

[2] The .05 alpha level of significance is a widely accepted threshold for statistical tests; findings that exceed this threshold, i.e., < .05, are believed NOT to be a result of chance.

words, student gain scores were examined to determine if the gains were likely due to the LHS intervention or are a result of random fluctuation. The analysis is focused on *just* those juniors whose ISTEP scores were available *and* who were enrolled in either Math Skills or English Skills. That reduced the number of students included in the analysis to:

	Math Skills	English Skills
Fall 1998:	136 students	97 students
Spring 1999:	82 students	52 students

The attitude and other data for the other students who used PLATO in other courses will not be examined here.

Evaluation Implementation

Procedures for data collection. The evaluator made a site visit in June 1999 and met and interviewed the following LHS faculty and staff:

7:30 Ms. Caroline Hanna, Principal
8:15 Ms. Pam Brandley, Math Chair
9:25 Ms. Dove Arnold, Math lab aide
10:15 Mr. Mike Kubek, Math lab aide
11:05 Ms. Bardonner, Language Arts teacher
12:30 Ms Judith Gibson, Language Arts Chair
Tim Courtney (PLATO EC)
1:10 Ms Pierce, Language Arts lab aide
2:00 Ms. Hanna, Principal

The evaluator used the PLATO site overview questions to structure the interviews, and then allowed the inquiry to be guided by the concerns and perspectives of the participants. Ms. Arnold agreed to administer the learner surveys to all classes that used PLATO, collect the completed instructor surveys that were distributed to faculty by the evaluator during each of the interviews, and to forward all data to the evaluator. Ms. Brandley provided comprehensive math records of all LHS students, some of which were used in the current analysis. Ms. Hanna provided student scores for the past three ISTEP tests.

Results

The results are organized into two sections, ISTEP scores and Attitudes/Beliefs. The ISTEP scores section examines the trend of the ISTEP scores for the rising seniors who participated in the Math and English Skills courses over the last three ISTEP tests. These student scores were analyzed for tests administered in Fall 1997, Fall 1998, and Spring 1999. In addition, Pearson product moment correlations were calculated between student grades earned in the Fall 1998 English Skills course and the English component of the ISTEP tests administered in Fall 1998 and Spring 1999. The Attitudes/Beliefs section presents the attitude questionnaire data for the instructors and students, and descriptions of the interviews with Ms. Hanna and other key PLATO instructors.

ISTEP Scores

Table 1 displays student mean scores for the Math and English/ Language Arts components of the ISTEP tests administered in the Fall 1997 and in Fall 1998. Test scores from these dates are important to examine because the Fall 1997 scores predate all of the ISTEP remediation efforts initiated by LHS, and the Fall 1998 test was administered in October of the Fall semester in which the ISTEP remediation courses were instituted. Only students who failed either of the Fall 1997 ISTEP components as sophomores *and* who participated in the ISTEP remediation courses as juniors were included in the comparison with the Fall 1998 re-test. Repeated measure ANOVA revealed that student ISTEP scores increased significantly on both the Math and English exams. In Math, student scored higher in the Fall 1998 re-test ($\underline{M}$ = 476.23) than they did on the Fall 1997 test ($\underline{M}$ = 450.41), $\underline{F}(1, 135) = 135.47$, $\underline{p} < .001$. On the English component, students improved to a mean score of 454.34 in Fall 1998 from a mean score of 429.33 in Fall 1997, $\underline{F}(1, 96) = 335.70$, $\underline{p} < .001$. In other words, those students who failed the Fall 1997 ISTEP exams and who were enrolled in the ISTEP Skills courses, scored quite a bit higher on the Fall 1998 re-test.

Table 1. ISTEP Scores for Fall 1997 and Fall 1998

ISTEP Test		Fall 1997	Fall 1998
Math	M	450.41	476.23
	SD	(32.9)	(35.3)
	N	136	136
English/Language Arts	M	429.33	454.34
	SD	32.7	39.34
	N	97	97

Note. Passing cut scores for both tests: Math 486, English 466

Table 2 displays student scores for the Math and English/ Language Arts components of the ISTEP tests administered in the October, 1998 and in March, 1999. Test scores from these dates are interesting to examine because it measures improvement among students who failed one component of ISTEP and who were enrolled in the ISTEP remediation program for both semesters. Similar to the earlier analysis, only juniors who failed either of the Fall 1998 ISTEP components *and* who participated in the ISTEP remediation courses were included in the comparison with the Spring 1999 re-test. Repeated measure ANOVA revealed that student ISTEP scores increased significantly on both Math and English. In Math, student mean scores rose to 493.11 in Spring 1999 from 457.09 in Fall 1998, $F(1, 81) = 229.03$, $p < .001$. In English, student scores improved to 457.64 in Spring 1999 from 429.85 in the Fall 1998, $F(1, 51) = 82.85$, $p < .001$. In other words, those students who failed the Fall 1998 ISTEP exams (for the second time) and who were enrolled in the ISTEP Skills courses, scored quite a bit higher on the Spring 1999 re-test. Importantly, the average score of 493.11 on the math re-test in the Spring exceeded the passing cut score of 486, and the average score of on the English component (457.64) approached the cut score of 466.

Table 2. ISTEP Scores for Fall 1998 and Spring 1999

ISTEP Test		Fall 1998	Spring 1999
Math	M	457.09	493.11
	SD	(26.1)	(26.4)
	N	82	82
English/Language Arts	M	429.85	457.64
	SD	(27.3)	(28.2)
	N	52	52

Note. Passing cut scores for both tests: Math 486, English 466

The English Skills course grades for Fall 1998 (where students work in the PLATO lab half of the time) positively correlated with the ISTEP scores. Students performance in the English Skills course was related to higher scores on both the Fall 1999 ISTEP English scores, $r = .441$, $p < .001$, and the Spring 1999 ISTEP scores, $r = .332$, $p = .028$. The data confirm a relationship between student grades in the English Skills courses and their scores on the English component of the ISTEP test, implying that students who succeeded in mastering the PLATO modules in the Skills course, tended to score higher on the ISTEP test.

Attitudinal/beliefs

Instructors. Table 3 displays the frequency distribution by item of the responses to the instructor survey administered in June, 1999. It includes: Part 1 - instructors' agreement or disagreement with different PLATO features; and Part 2 – instructors' descriptions of how often they perform certain priming and instructional activities in support of PLATO. Respondents included Ms. Gibson, English chair, and Ms. Pierce, English lab aide, Ms. Arnold, math lab aide, Mr. Kubek, math lab aide, and Ms. Brandley, math chair. Respondents' experience at using computers (including non-PLATO) in their teaching varied among respondents. Ms. Arnold reported she has used computers for 13 years, Ms. Brandley eight years, Ms. Gibson six years, and Mr. Kubek, one year. Instructor open-ended responses are summarized in Table 4.

Learners. Mean score responses to the Likert items in the learner survey are displayed in Table 5. These survey items are based on the respondents' agreement or disagreement with different PLATO features (Strongly Agree = 5, Agree = 4, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree). Part 2 of the learner survey asked learners to describe what they liked and disliked about PLATO and is summarized in Table 6. Figures 1 – 20 include bar charts displaying frequency distribution by response for each item on the learner survey.

Interviews

The interviews conducted by the evaluator during the early June, 1999 site visit are summarized and analyzed in this section.

Ms. Caroline Hanna, Principal. I met with Ms. Caroline Hanna, LHS principal, in her office from about 7:45 AM to 8:15 AM. She welcomed me into the school and was very helpful in providing me with an overview of the student body and the demographics of the surrounding area (described earlier). She also gave me some background about the history and politics of the ISTEP tests. The business of collecting data and interviewing faculty during a school day inevitably causes some disruption but she did her best to minimize it. She coordinated my entire visit, scheduling interviews with all the key players who used PLATO. She was interested in the evaluation to determine if their ISTEP remediation program initiated this past year, was in fact helping their low-achieving students succeed in passing the ISTEP re-tests. The pressure brought to bear on schools like LHS by statewide standardized tests is enormous and Ms. Hanna was understandably interested in analysis that could inform her strategies.

Ms. Hanna was very encouraged by the preliminary results of the ISTEP remediation program. She estimated that, out of 406 of the rising seniors who failed one or both parts of the ISTEP test as sophomores, all but 74 of them have since passed either the Fall 1998 test or the Spring 1999 test. She attributes much of this success to PLATO. "It has been great. It is a very useful program – I believe that PLATO got our failure rate down."

Ms. Hanna was overall very upbeat and positive. She is a career educator and long-time classroom teacher who seems to have an excellent rapport with the faculty. She clearly wants the best for her students and to give them the best possible chance to pass the ISTEP tests and move

on to graduation. From what I observed, the atmosphere in the school was upbeat and casual – with students and faculty seeming at ease with each other.

Ms. Pam Brandley, Math Chair. Ms. Brandley joined us in Ms Hanna's office at about 8:15 and we proceeded to her office to conduct our interview. Ms. Brandley has used PLATO for about 8 years and was also positive about it. Like Ms. Hanna, Ms. Brandley believes that PLATO has contributed to the math department's remediation program's success and was equally interested in the evaluation results. "The PLATO experience has been a positive one." She is an extremely organized teacher and department chair. She maintains electronic records of all math grades earned by all the students in the school – which she shared with me for inclusion in this evaluation.

In her view, PLATO's strengths were: its ability to provide immediate feedback and assessment; that it is a nice break for students, especially low-achieving students, who tire of listening passively to lectures; and that it gives students opportunity to work on the computes (which they enjoy and find somewhat motivational). The main weakness is that it requires too much reading for some students – and again particularly low-achieving students.

According to Ms. Brandley, 380 math students used PLATO during the current semester. She explained that *Fastrack* is used in all the courses in order to determine student grade level over basic skills. Students are then required to complete the curriculum set up for them based on *Fastrack* before they proceed to other math curriculum on PLATO. She indicated that students are allowed to take mastery tests to "place out" of modules and are required to study the tutorial if they fail it. Additionally, students are required to keep notebooks for the modules they work on. She described the lab manager and instructors' roles as "to roster each student into the proper programs and to assist and monitor student progress."

Ms. Dove Arnold, Math lab aide. I next visited the PLATO lab where Ms. Dove Arnold, the math lab aide, was just finishing a PLATO class. Ms. Arnold had used PLATO as a civilian in the military (Ft. Harrison) in 1986 and was instrumental in recommending its adoption at LHS.

Ms. Arnold believes that PLATO is ideal for low-ability students. She sees these students, many of whom feel like failures, gain in confidence and self esteem as they proceed through the modules accomplishing one small victory at a time. "There are many reasons why kids fail (ISTEP) tests. Initially kids feel inferior but that changes as they have success. I tell them 'there is nothing wrong with not knowing – we just want you to feel a little more comfortable for the next ISTEP.'"

Ms. Arnold has some recommendations to improve PLATO. She mentioned that some students complain that the tutorials are too long. She also thinks that more examples would be helpful.

Mr. Mike Kubek, Math lab aide. At about 10:15 AM, I visited Mr. Kubek, the other math lab aide. In the Fall, he, like Ms. Arnold, managed a Math Skills course that was entirely PLATO based. Students came into the lab every day for 1 ½ hours to work on their PLATO modules. But

in the Spring, they abandoned this intensive schedule in favor of an alternate lecture – lab schedule, whereby students would attend the PLATO lab on alternate days and receive specific, targeted classroom instruction on the other days. Mr. Kubek taught the classroom portion of this arrangement in the Spring, while Ms. Arnold managed all the lab sessions. Mr. Kubek, an LHS graduate, is not a certified teacher but is thoughtful about how PLATO was used. This is his second year in his role as teacher aide/instructor. Mr. Kubek completely concurs with the change from the full time Fall PLATO schedule to the modified alternate schedule adopted on the Spring. He believes that the Fall schedule was too much computer work, and too intense for students.

Mr. Kubek had some concerns and reservations about using (or over-using) PLATO. One shortcoming he identified was the program's lack of ability to check students work in a traditional word problem. "On the word problem section of the ISTEP test, students are required to show their work, and receive partial credit for correct portions of their answers; PLATO cannot replicate this testing condition." He observed that learners were able to "memorize" test items in PLATO if they took them often enough, thereby enabling students to pass mastery tests without actually knowing the content. He is concerned that there is little opportunity to review, i.e., once a student masters a module, they do not have to ever revisit it.

Mr. Kubek is concerned that teacher-student interactions may be diminished in a lab setting vs. a traditional class. He also thinks it is harder to assess student *understanding* given fewer interaction opportunities. In terms of suggestions, Mr. Kubek thinks that PLATO-supplied supplementary worksheets would be very helpful. He believes that students would benefit from having a hard copy of materials including reference materials as well as different types of exercises and practice problems[3].

Overall, Mr. Kubek was less enthusiastic than Ms Brandley and Ms. Arnold about PLATO and its utility in helping students learn math. He believes that students would be better served in a regular classroom environment – on the condition that the class size remains small. He concedes that as class sizes increase, the value-added for programs like PLATO also increases.

Ms. Judy Bardonner, English Teacher. I next moved on to the English department, where I first spoke to Ms. Bardonner at 11:15 AM. Ms. Bardonner is an English teacher with a background in Special Education. She was very positive about PLATO and its influence in the English Skills course. The English Skills course also used the alternate lab/lecture format that the math department adopted in the Spring. She liked the hands-on nature of parts of the program. "Some students are kinesthetic learners and need hands-on all the time. I also like the way the program is 'chunked.' Slower students don't get lost in the content – they can manage it on their own – which is important for their confidence. I really like that you can individualize the instruction for each student." When asked if she believed that PLATO was helping increase her

[3] A number of PLATO features, which might address these issues, such as supplementary worksheets, although available were apparently not used. A fuller discussion of these features appears in the Recommendations section.

students' ISTEP scores, she replied "Yes, I think it is." Similar to Mr. Kubek's suggestion, Ms. Bardonner also felt that PLATO-supplied hard copy support material would be useful.

Ms. Judith Gibson, English Chair. The chair of the English department, Ms. Gibson, was my next interview. I found her outside her office in the English office suite. Tim Courtney, a PLATO educational consultant, joined us. Ms. Gibson recalled the Fall technical problems but added "I think they are all behind us now." She had serious concerns about one of her lab assistants and was in the process of terminating her during my LHS visit. That caused her to reflect on the importance of the lab manager/aide in the success of PLATO. She said that since students are working on individualized curricula, it is extremely important that the lab person be "nurturing." Problems arose this past year because the current aide had little patience or compassion for her students.

Ms. Gibson, too was very positive about PLATO and believed it had helped many of her students pass the English portion of the ISTEP test. "I think it definitely has helped these kids get through ISTEP. We went to the block this year at the same time we decided to go with the PLATO lab Skills course – we had to do *something* to address the state scores. And I've been really happy with it. The program is very user-friendly and…I think we have fewer discipline problems because kids are engaged in their own work and don't have t listen to a teacher all day."

The final de-briefing session at 2:00 PM with Ms. Hanna was short but she wanted to be sure I had gotten all the data and information I needed. She gave me a folder of additional student grade information.

Discussion

ISTEP scores

By any measure, the ISTEP remediation program for 1998-1999 was a success. Student scores in both the Math and English components of the ISTEP test improved in both the Fall 1998 and the Spring 1999. In math, there were 204 students who started junior year needing to pass the ISTEP test and by the end of the academic year, that number was down to 37. Students experienced an identical success rate in English where the number of failing students also dropped from 204 to 37. The strategy of coupling PLATO and targeted classroom instruction for intensive and extensive remediation was quite effective. It does seem that Ms. Hanna's and other faculty members' belief that "PLATO got our failure rate down" is defensible. The fact that student success in the Skills courses was related to higher test scores suggests as much. It is not statistically possible to make any definitive causal relationship, i.e., PLATO *caused* higher test scores, but clearly, Ms. Hanna and faculty are not really interested in which part of the intervention strategy (PLATO or the classroom instruction) statistically contributed more to the improvement. The encouraging fact is that the combination of PLATO and the efforts of skillful and dedicated teachers *together* made a difference. PLATO – along with the classroom instruction – were both integral parts of the program's success. Bear in mind that prior to this academic year, these students had already failed the ISTEP test when they only had the benefit of classroom instruction so it is logical to conclude that adding PLATO to the mix was critical.

Attitudes/Beliefs

Students' responses to the survey items were generally favorable. It seems that the technical problems (see Appendix A) were less of a distraction for the students than they were for the LHS faculty. This is not really surprising given that students often view class interruptions as a break. Also, the surveys were administered in June 1999 – after the problems had been resolved. Perhaps some of the students who were affected had forgotten about it. [It is also true that those students who had passed the Fall 1998 ISTEP test were no longer in the Skills course in June 1999 and thus were not represented in the survey.] Instructors were also quite positive about PLATO. Most faculty believed that PLATO was responsible for helping their low-ability students pass the ISTEP test. Mr. Kubek expressed concerns but some of these could have been accommodated by PLATO features had he chosen to use them (discussed below in Recommendations).

Recommendations

It is possible that some of the problems or weaknesses described by faculty could have been avoided or mitigated by using some of the PLATO system features, or by using them differently. For example, in terms of the "no partial credit on word problems" limitation, PLATO does offer portfolio assessment support in its Math Problem Solving curriculum that may have been helpful in overcoming this limitation but Math Problem Solving was apparently not used. In any event, this is a case where the strategies employed by the instructor in the classroom instruction perfectly complimented PLATO.

Several teachers raised the concern that students with low reading ability have difficulty in PLATO. This problem is not unique to PLATO. This relationship has been found time and time again in educational research. In fact, some studies have shown that reading ability is an even stronger predictor of math achievement than math ability is. This points out the need to start weak readers in reading remediation before the math modules or at least to do them concurrently.

The lack of review cited as a PLATO limitation is really more of an individual teacher/instructor strategy issue. PLATO neither requires nor precludes review. Students can go back and revisit modules as often as needed. Teachers and students need to continually manage this important activity much the same way a classroom teacher does.

The problem with students memorizing mastery tests could have been avoided by setting the system to lock out a student after a certain number of tries on a question.

The lack of PLATO worksheets cited by two faculty members is also potentially a result of unfamiliarity of PLATO features. PLATO provides worksheets but it is unknown precisely what worksheets, if any, were used in the current implementation. It is also unclear whether the expressed need for additional exercises and problems is the result of lack of familiarity with what PLATO already provides.

Why was the LHS remediation program successful? The fact that students understood the stakes of the remediation courses, i.e., graduation, was undoubtedly important. But the faculty also helped keep a positive atmosphere in the courses - repeatedly reinforcing to these students that they were not "failures." Also they did not try to use PLATO for something it was not intended. PLATO modules are discrete units of instruction. They do not exist within an overall meaningful context, and they are inherently not structured as purposeful learning experiences in themselves. At LHS, they were used for skill acquisition and to complement the classroom experience. On alternate days, the teachers put the modules in context and encouraged students to work on the skills facilitated by the students' assigned PLATO modules. LHS also made a large investment in time to ensure the program's success. The importance of this huge commitment in time and resources toward remediating these students cannot be overemphasized.

Table 3

Instructor Survey Response Frequencies by Item
Part 1 Directions: We would like to know how you felt about your experience teaching with PLATO systems. For each of the statements below, please check the box under:

SA	if you strongly agree
A	if you agree
N	if you neither agree nor disagree
D	if you disagree
SD	if you strongly disagree

Item		SA	A	N	D	SD
1	The PLATO course content includes what my students need to learn about the topics taught.	2	2	1		
2	The PLATO course objectives correspond to those for my course.	1	3	1		
3	The PLATO course content corresponds to the content of the standard end-of-course test we use.	1	2	1		
4	Content seemed generally free of errors and inaccuracies.	1	2	1	1	
5	Content was generally up-to-date.	1	1	1		
6	Quality and style of instruction was consistent throughout the curriculum.	1	4			
7	Students generally understood the explanations.		3	2		
8	There was adequate depth in exercises and tests.		2	2	1	
9	Tests, application/drill lessons, and tutorials corresponded to the objectives in the Instructor Guides.	1	3	1		
10	Tutorials involved the students through frequent questions, answers and feedback, rather than just reading.		4		1	

		SA	A	N	D	SD
11	Software was generally free of bugs and errors.				2	3
12	All courseware used consistent keystrokes and display style.		1	3		1
13	Color was used appropriately.	2	3	1		
14	Graphics were used appropriately.	1	2	1	1	
15	Screens were consistently readable.	1	3	1		
16	I was able to use student progress reports to identify students needing my attention.	1	1	1	1	1
17	I was able to spend time in one-on-one tutoring and counseling while students used PLATO.	1	2	1		1
18	I was able to make appropriate individual student assignments on the system.	1	2	1		
19	My students were scheduled to use PLATO for as much as they needed.		4			
20	I was able to relate what the students studied on PLATO to what they studied in other activities.		3	1		
21	In general, my students respond well to the PLATO system.		3	1	1	
22	My students rarely seemed confused or "trapped" by the system.		1	2	2	
23	My students respond well to the PLATO system.		2	1	1	
24	I find working with the computer is generally a productive, rather than frustrating, experience.		2	2	1	
25	I enjoy working with the PLATO computer system.	1	1	2	1	
26	The PLATO system plays a useful role in my teaching.	1	2	1		
27	I was adequately trained to operate the PLATO system.		1	1	3	
28	I would like more training on how to use PLATO to best advantage in my teaching.		3	2		

Part II Directions: Please rate how often you performed the following activities in class before your students used PLATO. Circle your responses using the following scale:

5 Before or after each computer session
4 Before or after most computer sessions
3 Occasionally, before or after a new unit or lesson
2 At the beginning of each semester or marking periods
1 Maybe one time during the year
0 Never

Item		Rating					
		5	4	3	2	1	0
29	Articulated to the student(s) in some way those prerequisite skills, knowledge, or attitudes needed to fully succeed with their newly assigned PLATO modules.		3	1			
30	Helped the students relate what they were about to learn in their PLATO assignments to their own personal previous experiences.		2	1			
31	Described to the students the specific objectives they were going to learn within their assigned PLATO courses or modules.	1	1	1	1		
32	Explained to the students how the skills and knowledge learned within their assigned PLATO modules fit into the overall course lesson goals.	1	2				
33	Clearly identified to the students the rewards and incentives for trying hard and doing well within the PLATO system.		4				
34	Explained to the students specific procedures for getting support if they didn't understand something they were trying to learn within the PLATO system	1	2	2			

Table 4

Summary of Instructor Open-Ended Survey Responses

Part III Directions: Please write your responses to each question in the space provided.

The following keys (letters) are used to summarize the below responses:
A: Ms. Gibson (English/Language Arts, Chair)
B: Ms. Pierce (English lab assistant - she did not complete any responses)
C: Ms. Arnold (Math lab manager/instructor)
D: Mr. Kubek (Math lab manager/instructor)
E: Ms. Brandley (Math Chair)

1. What do you like **best** about teaching with the PLATO computer?

   A and E: "I like it as a support tool; hands on computer activities are VERY appropriate for low achievers."

   C. "Enables us to individualize curriculum and lets students work at different levels and at their own pace."

   D: "PLATO gives valuable practice at multiple-choice format."

2. What do you like **least** about teaching with the PLATO computer?

   A: "Some students (who need a lot of human contact) can get quite frustrated."

   C: "Explanations in tutorials need improvement."

   D: "Need to find ways to keep learners more interested."

   E: "Syntax caused frustration for students – they had the correct answer but did not know how to type it in - and we did not know what was wrong with the syntax they entered."

3. Was there a regular time…in which your students experienced their PLATO modules?

   A, C, D, and E: "Yes."

4. Describe any strategies you employed to determine whether or not the PLATO modules assigned to each student were the most appropriate for ensuring their success in your class?

   A: "Pre-testing and posttesting; individual conferencing."

   C: "One-on-one instruction with any student working on the tutorials."

   D: "We tried to pattern the material covered in the state assessment test on the PLATO system."

5. How would you change the PLATO lessons?

A: "Indicating to students individually after lessons about their growth/strengths/weaknesses."

C: "Consolidate the reviews and practice into one session – it is too overwhelming for students to be required to do 2 parts in a review."

D: "Provide worksheets with additional questions and problems to accompany tutorials and mastery tools."

6. What suggestions do you have to improve the way you use the PLATO system?

A: "Follow-up lessons to reinforce knowledge/experience/skills gained during summer and before state tests."

C: "Put in complete answers – not ones, tens, hundreds."

D: "Use PLATO less frequently – more as a break from the normal classroom routine."

7. What other comments or suggestions do you have on the PLATO system or this course?

A and C: Tim Courtney was very helpful. To our lab assistants; Classroom teachers need more training in running the program and reading reports"

D: "Upgrade graphics; increase game-like qualities of the program."

Table 5

Learner Attitude Survey Responses

Question		SA	A	N	DA	SD	n	M (SD)
1.	I am able to sign on to the computer without problems.	38	14	4	3	3	62	4.31 (1.11)
2.	Getting to my lesson is easy.	32	18	6	3	3	62	4.18 (1.11)
3.	The computer is easy to use.	30	19	5	5	3	62	4.10 (1.16)
4.	I can start and stop a lesson whenever I want.	29	17	6	7	3	62	4.00 (1.21)
5.	The computer lets me do something (like answer questions) often and not mainly just watch.	19	14	11	14	4	62	3.48 (1.32)
6.	I usually can understand what the computer teaches me, without help from my instructor.	12	19	11	13	7	62	3.26 (1.30)
7.	The computer gives me help when I need it.	5	15	15	17	10	62	2.81 (1.21)
8.	I can work at my own pace on the computer.	24	20	5	6	7	62	3.77 (1.36)
9.	I'm studying the same topics at the same time on and off the computer.	3	16	14	11	18	62	2.60 (1.29)
10.	My teacher helps me see the connection between what I'm studying on and off the computer.	10	14	18	9	11	62	3.05 (1.32)
11.	I feel I'm studying what I need to on the computer.	11	13	10	15	13	62	2.90 (1.42)
12.	The lessons on the computer are designed for people like me.	4	17	14	15	12	62	2.77 (1.23)
13.	When I give a wrong answer on the computer, I feel bad about myself.	4	11	12	11	24	62	2.35 (1.33)
14.	I would like more time to study on the computer.	10	11	14	10	17	62	2.79 (1.44)
15.	The computer makes me nervous.	3	9	7	14	29	62	2.08 (1.37)
16.	Working on the computer makes me feel good about myself	4	7	25	11	15	62	2.58 (1.17)
17.	I recommend learning from the computer.	5	15	14	9	19	62	2.65 (1.36)
18.	The computer lessons I work with are interesting.	4	10	14	16	18	62	2.45 (1.25)

19.	I try hard to learn from the computer lessons.	16	25	12	3	6	62	3.68 (1.20)
20.	The computer lessons make me feel more confident about doing well in school.	4	15	13	15	15	62	2.65 (1.27)

Table 6

Summary of Learner Open-Ended Survey Responses

1. What do you like **best** about learning from the computer?

Nothing (prefer teacher) [15]
Work at own pace [14]
Helps me learn what I really need to learn [9]
Easier [4]
Break for regular teaching [4]
No paper/written assignments [4]
Good examples/demonstrations [3]
Get more done [2]
Multiple choice format [1]
Fastrack program [1]

2. What do you like **least** about learning from the computer?

Slow computers [17]
Bored after awhile working alone [13]
Tutorials [7]
Time consuming/takes too long [7]
Nothing [7]
Don't learn anything [3]
Not able to retake tests/test items [3]
Can't talk to computer [2]
Not enough word problems [1]
Too many programs [1]
Testing on everything [1]
Problem solving [1]

3. How would you change the computer lessons or the way you use them?

Make program (logging on) faster [15]
Make it more fun/interactive [10]
Make tutorials shorter [10]
Not use it [6]
Give more chances on mastery tests [5]
More like games [4]
Make it more compatible [3]
Make it easier [2]
Nothing [2]
More interesting [1]
More word problems [1]
More examples [1]

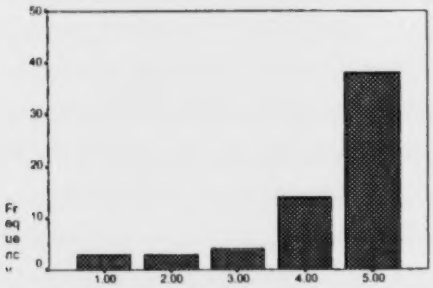
4. What other suggestions do you have to improve any part of the course(s) which use PLATO?

No response [35]
Not use it [6]
More like games [4]
Don't use the computers as the grade [3]
Use faster computers [3]
Make mastery tests easier [2]
Test over a variety of math [1]
Let teachers help [1]
Use with other subjects [1]
Have a book with it [1]
Take more breaks [1]
Take out animation [1]
Have problems similar to ISTEP [1]

Figures 1 – 20

Bar Charts for Learner Survey Attitude Items 1 through 20

Item 1



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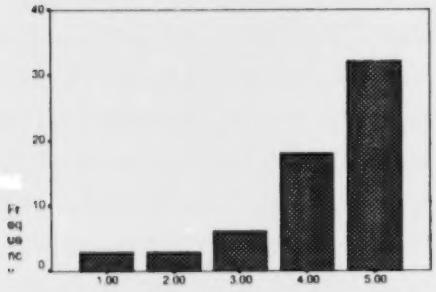

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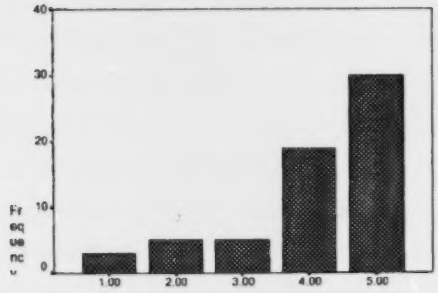

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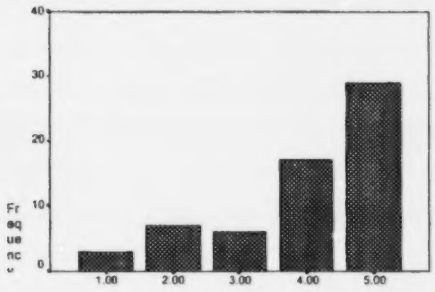

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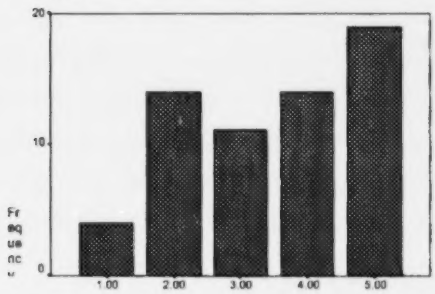

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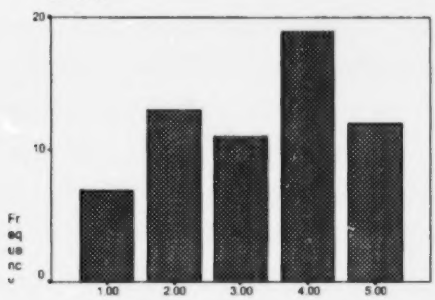

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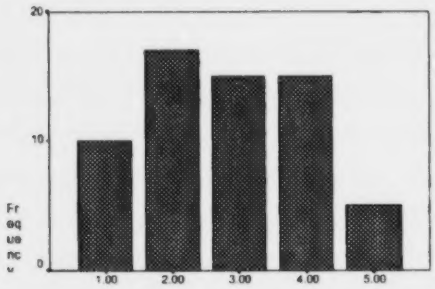

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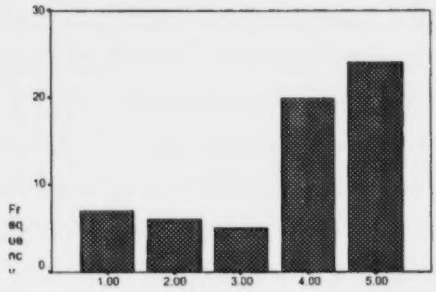

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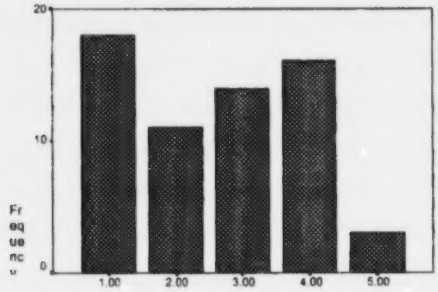

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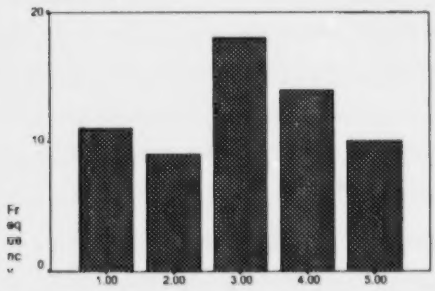

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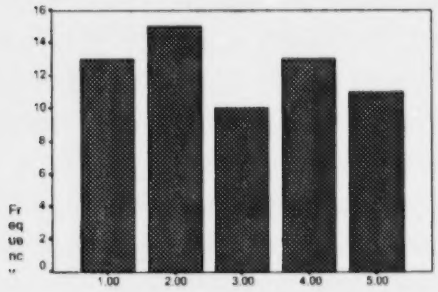

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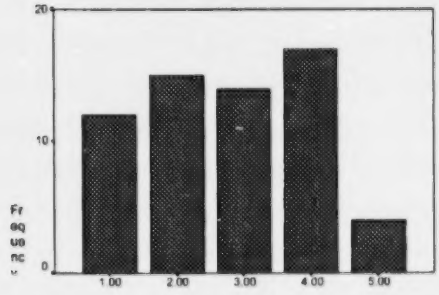

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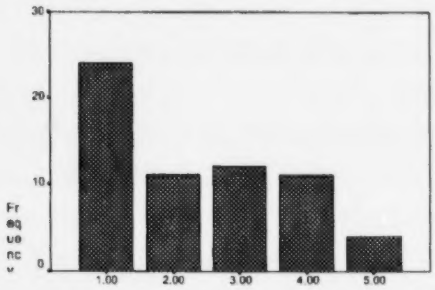

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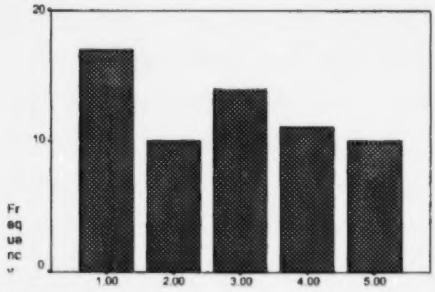

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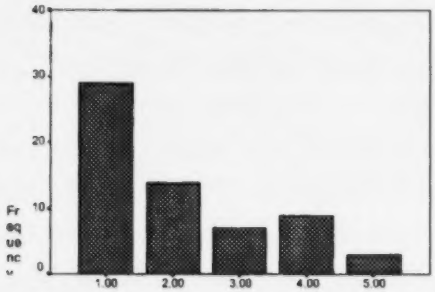

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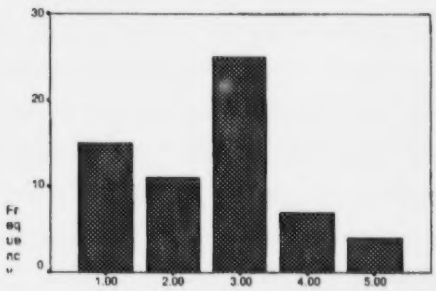

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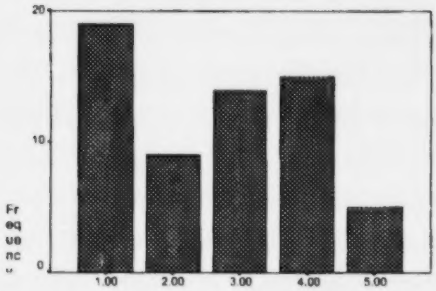

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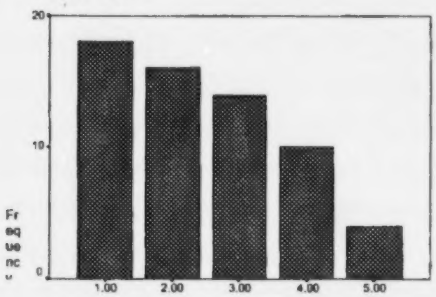

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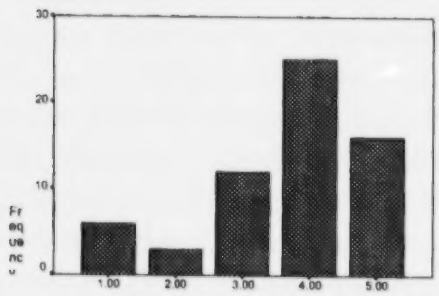

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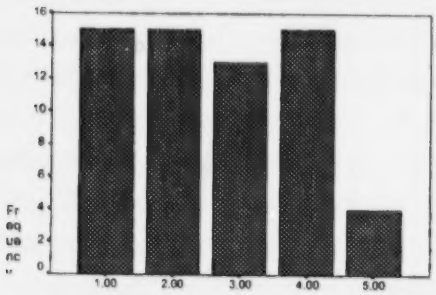

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Appendix A

Description of Technical Problems

The principal was the first to inform me about the technical problems resulting from their PLATO upgrade in Fall 1998 – concerns later echoed by all interviewees.

In general, LHS was very pleased with PLATO (reflected in numerous interview comments reported in the Results section) and prior to this year they had few technical problems. However, this year was marked by numerous technical problems related to the upgrade to Pathways 3.14. The problems were apparently severe enough to force cancellation of many classes during the Fall 1998 semester. The two most chronic problems were student inability to logon and the freezing of machines causing loss of student work. PLATO Learning support was described as adequate, but in light of the persistence of the problems (as relayed by several faculty and staff), it is likely that the support could have been better/more timely.

Ms. Arnold was the person most affected by the technical problems. As a result of these disruptions, she did not even know from day to day if her class would be able to use the lab. "In the Fall, I would have to always have a back up plan because I never knew when the server would crash, or students would not be able to logon. It got better in the Spring, but we still had problems." She estimates that problems forced problems in up to 40 % of the Fall classes, and up to 15 % of the Spring classes. The system became so unstable that she no longer agreed to host visitors from other school districts who were interested in adopting PLATO – a practice she had carried on for several years. She described several cases where students lost entire semester's work. Despite the problems, she is still positive about PLATO and looks forward to better performance next year.

The entire LHS faculty as "extremely helpful and responsive" roundly praised the PLATO Educational Consultant, Tim Courtney. The problems were resolved by the end of the 1998-1999 academic year.

PLATO

Site:
North Lake College
Dallas County Community College District
Dallas, Texas

Student Population:
Job Training Partnership Act (JTPA) eligible youth and adults who had dropped out of school or who were potential dropouts.

Program Description:
The Local PLATO Delivery System was used to provide each participant with 180 hours of instruction over a twelve-week period. Emphasis was placed on basic skill development, General Educational Development (GED) exam preparation, and life coping and job skills awareness.

Program Goals:
- To improve the reading, mathematics, and writing skills of each participant by one or more grade levels
- To move students forward toward the achievement of a high school diploma or GED certificate
- To provide basic skills instruction to high school students as they prepare for the Texas Educational Assessment of Minimum Skills (TEAMS) examination
- To increase each participant's awareness of life coping and job skills

Pre/Post Academic Test:
Texas Educational Assessment of Minimum Skills (TEAMS)
General Educational Development (GED)

PLATO Courseware:
Basic Literacy Skills: Reading and Mathematics
Advanced Literacy Skills: Reading, Mathematics, and Writing
Life Coping Skills

Results:
- 88% of the students were considered positive completions by improving one or more grade levels in one or more basic skill areas.
- 82% of the group considered "at risk" were enrolled in high school the next academic year.
- 15% of the dropout group returned to high school.

- 23% returned to North Lake's program for GED preparation.
- 15% continued with North Lake's remediation program.

	Average Grade Level Increase
Mathematics (n=24)	+1.8
Reading (n=24)	+1.7

Evaluation Period: 1988 academic year – second semester

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Evaluation Series

Eastern High School
Life Skills Class

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Executive Summary

Six life skills students with varied mental disabilities received math instruction through the use of PLATO computer-assisted instruction program for math. The purpose was to determine whether the use of computer-assisted instruction increased the student's interest and time on task in math. The results suggest that the use of computer assisted-instruction clearly increased student's interest in math.

Keywords: PLATO, CAI, Secondary, Mentally Retarded, Life Skills, Technology, Evaluation

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Editor's Note: This study uses a qualitative methodology to address the issue of effects of PLATO's Math Fundamentals curriculum with a small group of mentally retarded learners. Programs for these learners generally do not use standardized tests, and thus typical quantitative evaluation methodologies are not an option. Studies of the effectiveness of CAI with learners of this type are rare, however, so we are publishing this report.

Introduction

In the last twenty years, computers have become ubiquitous in today's society. A person can barely get through a day without utilizing some sort of microchip technology. One area that has seen a great deal of promise in utilizing computer technology is the field of education. Computer assisted instruction (CAI) has been around since the early Sixties. Many studies have been conducted as to the efficacy of CAI and its ability to instruct students; however, very few studies have been conducted to determine the effectiveness of CAI and its ability to instruct mentally handicapped students. This research study will set out to ascertain whether or not CAI is a viable means of instructing mentally retarded students.

Most mentally handicapped students lack basic math skills, and this shortcoming is a major obstacle to their overall success in mathematics and ultimately in life. As mentally handicapped children get older, they fall further and behind non-handicapped peers when they are asked to recall information (Hasslebring et al, 1988). With the ability of CAI to deliver focused, individual instruction, it would be hoped that mentally handicapped students would be able to increase their basic skills and advance to more difficult learning tasks. For example, if a student is able to readily recall simple mathematical knowledge, that student will be better equipped to handle more difficult mathematical problems.

The purpose of this study was to determine whether or not PLATO's CAI in math is effective for life skills high school students. PLATO's tutorial CAI is as a computer program that employs a tutorial, drill, and mastery test format[1]. Effectiveness was determined by an increased interest in math and increased time on task in math. Life skills students are special education students whose disabilities include mental retardation, cerebral palsy, and Down's Syndrome.

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[1] Other parts of PLATO use a wide range of additional instructional models, such as problem-solving activities. However, they were not included in this study.

This research study is significant on several levels. One, it will be assumed that if PLATO CAI is effective in teaching math to this life skills class, then it will be assumed that any life skills class would find this program effective. Two, this study will determine whether PLATO is effective in increasing the time on task in math for life skills students. Three, if PLATO is successful in this setting, then the program should be of use to other life skills teachers.

LITERATURE REVIEW

There are many noted benefits of utilizing CAI in the classroom. Early CAI programs were used primarily for reinforcement purposes. As CAI programs have evolved, they have been developed to teach students with disabilities. CAI, when well-designed and routinely applied in classrooms, has the potential to reinforce teacher instruction and provide additional teaching to increase practice time (Hall et al.; 2000; Hasselbring et al., 1988).

Educators and researchers in special education have seen a positive impact by using educational technology for students with disabilities. In a meta-analysis of literature pertaining to the effectiveness of CAI, Hall et al. found that 13 of 17 studies showed positive increases in student learning where CAI was utilized (2000). Hasselbring et al. found that, when properly implemented, CAI is a highly effective method of instructing mentally handicapped students (1988). Hitchcock and Noonan found CAI to be a more effective method of instructing mentally disabled students over teacher-assisted instruction (2000).

Researchers have learned that computers have the ability to deliver, "motivating, carefully monitored, individualized.... practice in concentrations far beyond those available in traditional instructional format" (Hall et al., 2000). In addition, the methods of instruction most commonly used to teach special education students—individualized instruction, drill and practice, and immediate feedback—are typical features of CAI (Schmidt et al., 1985-86). CAI allows students to be assigned additional instructional time to provide teaching and practice in a particular skill area with minimal direct instruction from the teacher (Hall et al., 2000).

Schmidt et al. cite many reasons why CAI is an effective medium of instruction. Some of these explanations include: a secure one-on-one learning environment, truly individualized programs of learning, prompt and immediate feedback, mathematical and linguistic modeling, and a multisensory learning environment that includes visual and auditory stimuli (1985-86).

Hitchcock and Noonan discovered that CAI is an effective method of building academic skills in preschoolers with disabilities. They found that CAI was more effective in teaching basic skills than teacher-assisted instruction. In addition, they discovered that students with mild disabilities learned twice as much through CAI than conventional methods (2000).

There are several reasons that CAI is deemed to be more effective than traditional direct teacher instruction. CAI, by its design, can be adapted to the different levels of instruction with exceptional children (Schmidt et. al., 1985-86). Computers are also motivating to students (Hall et al., 2000). Hitchcock and Noonan discovered that students frequently asked to use the computer-assisted programs (2000). One reason that CAI is motivating may be because it is an attractive and engaging learning medium. In addition, students remain on task for longer periods when they are able to control the activities on the screen (Hitchcock and Noonan, 2000; Harrison et. al., 1998).

The ability of CAI such as PLATO to be adapted to the individual learner is one positive aspect of CAI. Using the management system employed in some CAI programs, a teacher is able to carefully assign lessons that are appropriate for each individual learner. The learner is then free to work on his or her assignments in a private setting until the objectives of the particular lesson are mastered.

CAI such as PLATO also provides immediate corrective feedback or immediate positive reinforcement to the learner. Immediate corrective feedback that instructs the students as to the source and cycles the student through more practice has been found to be highly effective (Hall et al., 2000).

In spite of all the literature available on the topic of CAI and its effectiveness, very little of this literature focuses on CAI and mentally retarded students. Hitchcock and Noonan noted that few studies have been done to evaluate whether CAI is more effective than tradition methods of teaching learners with disabilities (2000). It is therefore the purpose of this study to add to the body of literature dealing with CAI and mentally retarded students.

DESIGN AND METHODOLOGY

This study focused on six students in the high school Life Skills class from the Eastern High School[2] in a Pennsylvania School District. They are 5 boys and 1 girl. Peter, a 16 year old boy with Downs Syndrome, is able to add one digit numbers. Paul, a 17-year-old boy who suffers from cerebral palsy and mental retardation, is able to work effectively with money and can do addition, subtraction, and basic multiplication. Andre, a 16-year-old boy with Downs Syndrome, is able to do basic addition and subtraction of one digit numbers. June, a 15-year-old girl with mental retardation, can add and subtract one digit numbers. Howard, a 17-year-old boy is mentally retarded, is able to perform two-digit addition and subtraction. Juan, a 15-year-old boy who is mentally retarded, can perform two digit addition and subtraction. The time frame of the study was from the beginning of April 2001 to the beginning of May 2001.

CAI, for the purpose of this study, is defined as software designed to teach toward a curricular goal, to provide instruction and practice toward the achievement of an immediate learning objective (Posgrow, 1990). The PLATO Math Fundamentals curriculum was used in this study. Data collection included field observations in the beginning of April and the beginning of May. The amount of time on task by each student was recorded for both observations. Individual student interviews also were conducted. During these interviews, the students were asked about their feelings and attitudes about doing math. These interviews will again take place at the beginning and end of the study time frame.

The criterion for assessing whether or not PLATO is effective in math for life skills students will be based on the following. If the amount of time on task has increased by ten minutes from the beginning of the study to the end, then PLATO is effective. If comments about math by students have changed and are clearly positive, then PLATO is effective. If both are true, then PLATO improves time on task and interest in math for high school life skills students.

[2] Names of the school and the learners have been changed to protect their privacy.

RESULTS

During my first observation of the students, I interviewed each student in private to attempt to gain a feel for each student's attitude toward math and computers. Four of the six students said they enjoyed math. When asked if they enjoyed doing math worksheets, three out of six students said they enjoyed doing math worksheets. Juan, a student who responded negatively toward worksheets, said, "As soon as you are done one, [the teacher] gives you another one." Another student responded that worksheets are, "boring." Paul's answer was mixed. He stated that he liked doing worksheets, but that they got boring after a while.

When asked whether students enjoyed using a computer, all responses were very positive. June remarked that she "loved using the computer." All students use a word processing program daily to type a short five-sentence paragraph that they write in the morning. The students also enjoy using the Internet and playing computer games. Students are currently being instructed how to use email.

When the students were asked to project whether or not they believe they would enjoy doing their math assignments on the computer, all but two responded affirmatively.

To collect the data for time on task, I observed the students doing math and recorded every minute of time on task. However, it was difficult to ascertain an accurate time on task. Some students were pulled to go with specialists, some students had to go to work, and others had to run other errands. What I found was that the students worked for an average of 19.8 minutes on their math assignment. The teacher had to redirect students to remain on task at frequent intervals.

During my second round of interviews, the students felt much differently about their math than during the first interview. All students who participated in this research project reported a positive experience using CAI to complete their math work. Paul told me "It is easier. It tells you what to do." When asked to be more specific, it was determined that he liked the immediate corrective feedback if he got a question wrong and the positive feedback when he answered a question correctly. Juan also stated that he liked the corrective feedback and positive rewards built into the program. Howard noted that he liked CAI because if he got a question wrong, the program instructed him how to answer the problem

correctly and then gave him another chance to answer the problem correctly.

The teacher noted some of the comments made by the students. She told me that some of her students were beginning to understand their addition better by being introduced to an addition table through the program. Howard said, "Look how else you can do this problem," referencing the addition table. The students found the color graphical interface to be both stimulating and engaging. Paul stated that he "liked the pictures." When asked if they felt that they were spending more time doing math with CAI, all students responded that they were spending more time on their math assignments.

I also asked each student if they could tell me one new thing they learned by using the computer. Paul told me he learned how to borrow in subtraction. Juan said he learned how to carry while doing addition. Howard found the addition table to be useful.

Standard reports that are included as part of the PLATO system were run to determine the amount of time each learner spent on task. The results of these reports are inconclusive due to computer problems. The PLATO system tracks time on task from the moment the student enters a lesson and does not have the capability to actually track keystrokes as a way to track time. The students had a per session average of 16.9 minutes to 60.9 minutes. These numbers will be elaborated on in the discussion section.

DISCUSSION

The results of this study suggest that the use of PLATO in a life skills class is effective. In analyzing the students' comments, they were all clearly positive in regards to completing their math on the computer versus doing worksheets. The teacher also reported that the students would ask her to be able to use computer to complete their math work even when it was not math time. This clearly indicates that PLATO raised interest level in math for life skills students.

The results of the time on task were not as clear. During my initial observation, the students worked on their math worksheets for an average of 19.8 minutes. The time on task reports that were generated by the PLATO program showed students working for times up to one hour. I was, initially, pleasantly surprised by these results until the teacher informed me that these times were not accurate due to computer problems. She told me that she would not log the students out because they would sometimes have troubles logging back on to the system. Since the PLATO program tracks time on task from the moment they log on, this is the reason some students have upward of one hour of continual time on task. It is therefore impossible for me to determine actual time on task for each student's PLATO session.

What this study did conclude is that PLATO does have a positive affect on life skills students' attitudes toward their math work. If the students have more interest in math, then they will be more inclined to complete their math tasks and therefore will become better prepared to handle math in their lifetimes. It is uncertain whether the CAI program used actually increased the students' time on task due to the inaccuracies uncovered in the reporting process.

There are some limitations that will impact the generalizability of these results. The inaccurate time on task has obvious effects on the outcome of this study. The limited sampling, using only six students, will also limit the degree to which these results can be generalized to other life skills students. The time frame in which this study was conducted will also have negative effect on the results. Another limitation will be the teacher's input to assist students while working with the computer program. If the teacher offers assistance too quickly, this could shortcut the program's ability to effectively instruct the students. A longer period of time in which to conduct the study would produce more meaningful results.

CONCLUSION

This study set out to determine whether PLATO CAI is effective in math for life skills high school students. PLATO had a definite positive impact on the students' attitudes toward math. After PLATO was implemented in the classroom, all students reported an improved, more positive attitude toward math. Due to the manner in which the program was left on when students were not in the room, it is unclear whether or nor PLATO increased time on task for high school life skills students in math. The results of this project, while promising, are not clearly definitive.

It is recommended that more research be done in this field. Since the results of this research study are not definitive, more research needs to be done to determine the effectiveness of using PLATO with life skills students. It is also recommended that future studies sample a larger population to make the results easier to generalize. Future samplings should also be done over a longer period of time to allow for increased interaction between the learners and the PLATO program utilized.

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